Biocompatibility of Composition of Aluminum-Silica Carrier and Extract of Matricaria chamomilla and Bidens tripartita with Monocytic Lines

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***Abstract*—This work described biocompatibility of composition of *Matricaria chamomile,* and *Bidens tripartite extracts* with particles of porous aluminum oxide with polydimethylsiloxane (Al/PDMS/CM/BT) on THP-1 and U-937 cell lines *in vitro*. Effects of Al/PDMS/CM/BT on THP-1 and U-937 cells NAD (P) H-dependent oxidoreductase intracellular enzyme activity, lactate, glucose and NO levels in conditioned media were studied. It was found that extracts of *Matricaria chamomile* and *Bidens tripartite* alone, and Al/PDMS/CM/BT decreased NAD (P) H-dependent oxidoreductase intracellular enzyme activity of THP-1 cells compared with control (p p≤0.05). While aluminum-silica carrier, herbal extracts of *Matricaria chamomile* and *Bidens tripartite* alone, and Al/PDMS/CM/BT decreased lactate release by THP-1 cells compared with control (p≤0.05). We established that aluminum-silica carrier, extract of *Bidens tripartite* inhibits NAD (P) H-dependent activity, and extract of *Matricaria chamomile* increased NAD (P) H-dependent activity of U-937 cells compared with control (p≤0.05). While herbal extracts of *Matricaria chamomile* and *Bidens tripartite* alone decreased lactate production and glucose consumption by U-937 cells.**

Keywords—Matricaria chamomile, Bidens tripartite, aluminum oxide with polydimethylsiloxane, THP-1, U-937, MTT, lactate, glucose, NO

I. INTRODUCTION

The infusion of *Matricaria chamomile* flower baskets has an anti-inflammatory, haemostatic, antiseptic, weak astringent, analgesic, sedative, anticonvulsant, diaphoretic, choleretic effect [1]. The presence of manganese in the *Bidens tripartite* gives an excellent opportunity to use the plant as a means of caring for skin diseases. Drugs based on a series dry out the foci of inflammation, relieve pain and stimulate the development of tissue cells [2]. In this report, we aimed to study the biocompatibility of the composition of aluminum-silica carriers with herbal extract on monocytes cell lines *in vitro*.

II. MATERIAL AND METHODS

The γ-Al_2O_3 particle with size 0.1 mm was modified by polydimethylsiloxane (Al/PDMS), and used as drug carrier [3]. Sorption of *Matricaria chamomile* (MC) and *Bidens tripartite* (BT) extract (2%) was carried out in the aqueous phase at room temperature on Al/PDMS surface (Al/PDMS/MC/BT), followed by drying at a temperature of up to 50^o C.

Monocytes cell lines THP-1 and U-937 was cultured in RPMI-1640 medium supplemented with 10% fetal calf serum, 2 mM L-glutamine, 5 mM Hepes-buffer, and 1% of antibiotic/antimycotic in tissue flask, culture medium refreshed every 3-4 days. The 10^6/well of THP-1 or U-937 cells was sided into 24-well plate in culture medium, Al/PDMS, Al/PDMS/MC/BT, *Matricaria chamomile*, and *Bidens tripartite* (0 and 1 mg/mL) was added into wells. Cytotoxicity of the used regents was done by MTT-test. Lactate, glucose, and nitric oxide (NO) levels were measured in supernatants using spectrophotometer.

Statistical comparisons of obtained data were done by an ANOVA followed Bonferroni post hoc test. Data are expressed as means ± SD, differences were considered significant at $p \leq 0.05$.

III. RESULTS

Obtained composition of herbal extract with aluminum-silica carrier was bulk powder. In Table 1 summarized effects of herbal extract on THP-1 cell line functional activities in *vitro*.

Herbal extract of *Matricaria chamomile* and *Bidens tripartite* alone and in combination with drug carrier significantly decreased NAD (P) H-dependent cellular oxidoreductase enzymes activity of THP-1 cells compared with control ($p \leq 0.05$).

Drug carrier and herbal extracts alone, and in combination reduced lactate production by THP-1 compared with control levels ($p \leq 0.05$).

Moreover, herbal extract alone and in composition with drug carrier increased glucose consumption by THP-1 cells compared with control and drug carrier ($p \leq 0.05$). While drug carrier alone decreased glucose consumption compared with control group ($p \leq 0.05$).

The herbal extracts alone increased NO production by THP-1 cells compared with control and carrier drug group ($p \leq 0.05$).

In Table II summarized effects of herbal extract and drug carrier on U-937 cell line functions. The NAD (P) H-dependent oxidoreductase enzyme activity was inhibited in the presence of drug carrier and *Bidens tripartite* extract, and increased in the presence of *Matricaria chamomile* and composition of herbal extract with drug carrier compared with control group ($p \leq 0.05$).

The lactate levels in conditioned medium from U-937 cells were significantly decreased under herbal extract condition compared with control and Al/PDMS group ($p \leq 0.05$).

While glucose consumption by U-937 cells was decrease in the presence of Al/PDMS, *Matricaria chamomile* and *Bidens tripartite* compared with control ($p \leq 0.05$).

TABLE I. EFFECT OF THE HERBAL EXTRACT ALONE OR IN COMBINATION WITH ALUMINUM-SILICA CARRIER ON THP-1 CELL LINE PROPERTIES IN VITRO (M ± SD)

Parameters	**Basal**	**Al/PDMS**	**Al/PDMS/ MC/BT**	**MC**	**BT**
MTT assay, OD	0.18±0.01	0.37±0.01*	0.16±0.01*#	0.13±0.01*#	0.13±0.01*#
Lactate, μM/L	1.53±0.1	1.33±0.1*	1.45±0.1*#	0.93±0.1*#	1.3±0.1*
Glucose, μM/L	5.2±0.1	6.74±0.1*	4.91±0.1*#	4.97±0.1*#	4.86±0.1*#
NO, μM/mL	4.65±0.2	5.0±0.2	6.15±0.2*#	6.35±0.2*#	4.85±0.2

Note. Al/PDMS, porous aluminum oxide with polydimethylsiloxane particles; Al/PDMS/MC/BT; MC, Matricaria chamomile; BT, Bidens tripartite; MTT assay, 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide transformation into insoluble formazan by NAD(P)H-dependent cellular oxidoreductase enzymes in live cells; OD, optical density (λ=540 nm); NO, nitric oxide. *p≤0.05 compared with control; #p≤0.05 compared with Al/PDMS.

TABLE II. EFFECT OF THE HERBAL EXTRACT ALONE OR IN COMBINATION WITH ALUMINUM-SILICA CARRIER ON U-937 CELL LINE PROPERTIES IN VITRO (M ± SD)

Parameters	**Basal**	**Al/PDMS**	**Al/PDMS/ MC/BT**	**MC**	**BT**
MTT assay, OD	0.28±0.01	0.14±0.01*	0.33±0.01*#	0.35±0.01*#	0.26±0.01*#
Lactate, μM/L	2.26±0.1	2.27±0.1	2.28±0.1	3.08±0.1*#	2.73±0.1*#
Glucose, μM/L	2.26±0.1	3.6±0.1*	2.28±0.1#	3.08±0.1*#	2.73±0.1*#
NO, μM/mL	4.65±0.2	5.25±0.2*	7.2±0.2*#	3.95±0.2*#	4.85±0.2

Note. Al/PDMS, porous aluminum oxide with polydimethylsiloxane particles; Al/PDMS/MC/BT; MC, Matricaria chamomile; BT, Bidens tripartite; MTT assay, 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide transformation into insoluble formazan by NAD(P)H-dependent cellular oxidoreductase enzymes in live cells; OD, optical density (λ=540 nm); NO, nitric oxide. *p≤0.05 compared with control; #≤0.05 compared with Al/PDMS.

The NO production by U-937 cells was changed under drug carrier, and composition of herbal extracts with drug carrier condition compared with control and herbal extract alone groups ($p \leq 0.05$).

IV. DISSCUSSION

We have found that herbal extract alone on in combination with aluminum-silica drug carrier possess to inhibit some enzyme intracellular activity in monocytes cell lines.

Matricia chamomilla used medical plant in folk and traditional medicine. *Matricia chamomilla* possess anti-inflammatory and antimicrobial activities. *Matricia chamomill*a are source of the different type of the glycosides, terpens, flavanoids and coumarin [4, 5].

Bidens tripartite used for upper respiratory tract and gastrointestinal infections treatment. *Bidens tripartite* used for diabetes mellitus therapy as hypoglycemic agent. Moreover, *Bidens tripartite* possess anti-inflammatory, anticancer activities [6].

Cavalcante and coworkers found bisabolol in dosage 3, 10, 30, and μg/ml did not have toxic effect on neutrophils [7]. Moreover, bisabolol in dosage 1 and 3 μg/ml increased phagocyte activity of neutrophils.

Asadi and coworkers observed increased cell viability of Balb/c macrophages under *Matricaria chamomile* condition, and increased production of NO by macrophages and lymphocytes [8].

Moreover, treatment of the lymphocytes with *Matricaria chamomile* possessed Th1 polarization. *Matricaria chamomile* decoction extract inhibits reactive oxygen species by neutrophils 9].

Skin application of oil *German chamomile* in mice with dinitrochlorobenzene-induced dermatitis decreased serum levels of IgE and IgG1 [10].

Bidens tripartite widely used as antiseptic, anti-inflammatory compounds. No has obtained negative effects of alcoholic and aqueous extracts of *Bidens tripartite* in animal on leucocytes quantity and lymphocytes quality [11]. While, toxic effect of alcoholic extract of *Bidens tripartite* observed in dosage 4038 mg/kg in mice [12].

This is a first study to demonstrate the effects of the composition base *Matricaria chamomile* and *Bidens tripartite* extracts with particle of γ-aluminum oxide with polydimethylsiloxane on monocytes cell lines in vitro.

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